

[54] **METHOD AND APPARATUS FOR CONTINUOUSLY REELING WEBS OF MATERIAL INTO INDIVIDUAL ROLLS**

[75] Inventor: **Gerhard Walter Dörfel**,
Weilheim-Teck, Germany

[73] Assignee: **A. Ahlstrom Osakeyhtio**,
Noormarkku, Finland

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[51] Int. Cl. **B65h 17/08, B65h 19/26**

[58] Field of Search..... 242/66, 68.7, 78.7, 56 R,
242/55.1, 65

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Primary Examiner—John W. Huckert
Assistant Examiner—Jon W. Henry

[57] **ABSTRACT**

In a reeling process and apparatus for reeling webs of material, such as paper webs, into individual rolls, of the type wherein the roll being formed rests on parallel adjacent rollers and receives its driving force therefrom and wherein the completed roll is cut off from the coming web by a cutting device and then is removed and a new empty reel is brought into contact with the supporting rollers, improved operation is achieved by bringing the empty reel on one side of the supporting rollers to a tangential position in relation to the web so that a clearance in relation to the supporting rollers is allowed for, and by simultaneously, or almost simultaneously with the separation of the completed roll activating means for bringing the empty reel into contact with the supporting rollers, and at the same time, or possibly even somewhat earlier, forcing the completed roll to roll off the supporting rollers laterally. The apparatus may comprise a receiving roller positioned in front of the gap between the rollers, by which the empty reel coming from a reel supply may be pushed through the gap between the rollers to the reeling side thereof.

6 Claims, 21 Drawing Figures

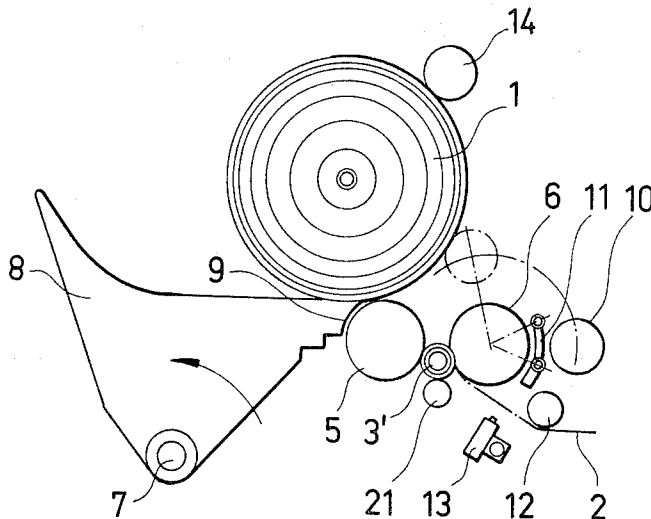


Fig. 1

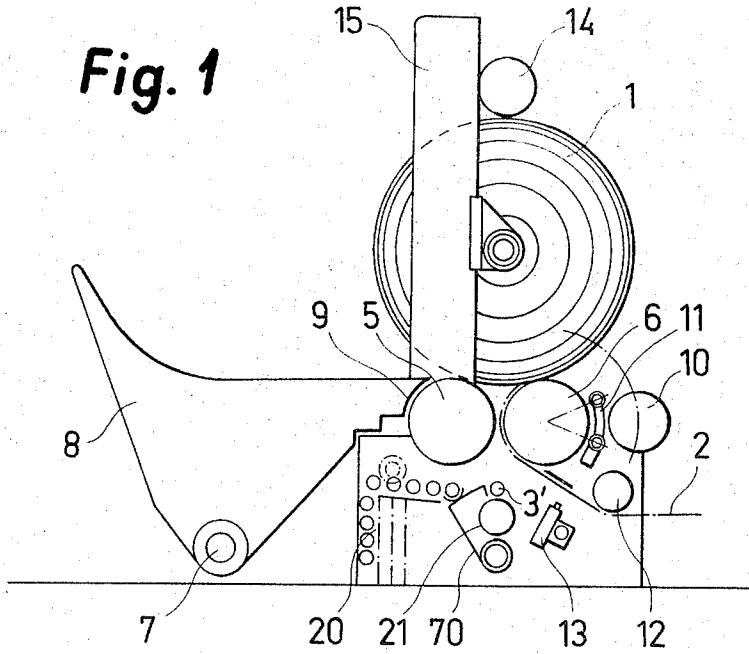


Fig. 2

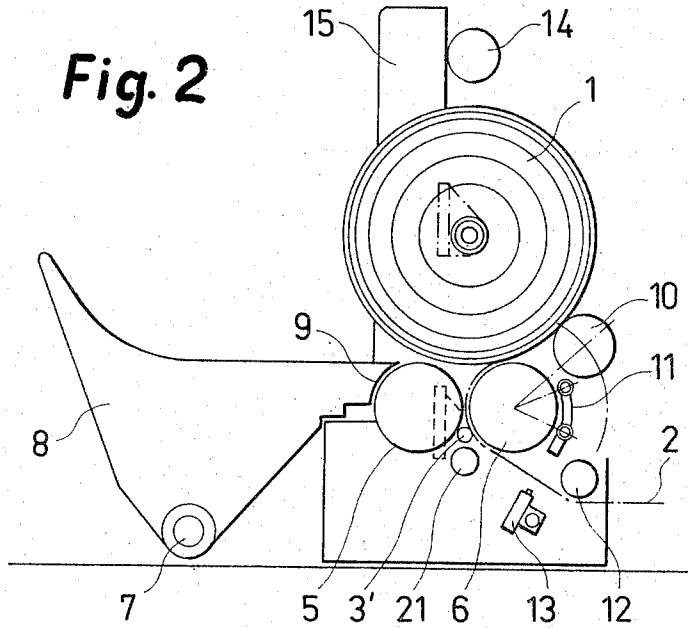


Fig. 3

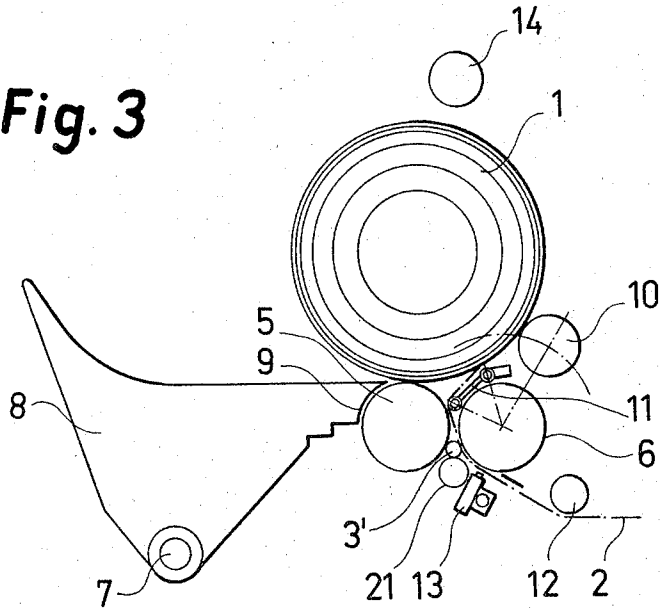


Fig. 4

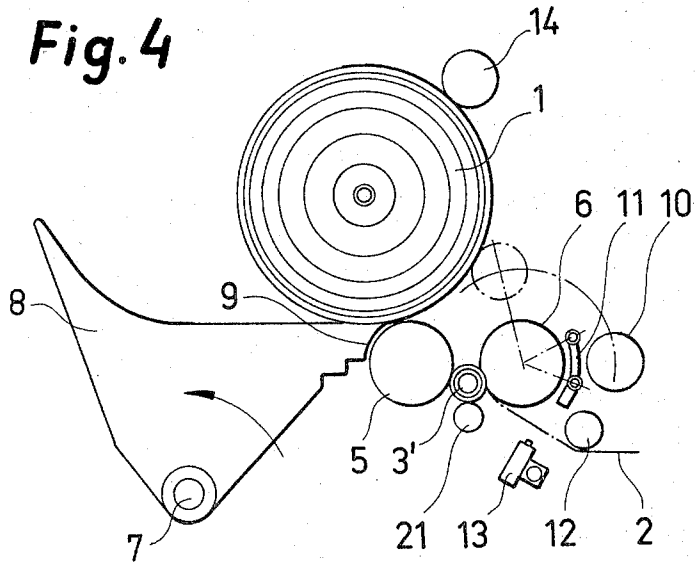


Fig. 5

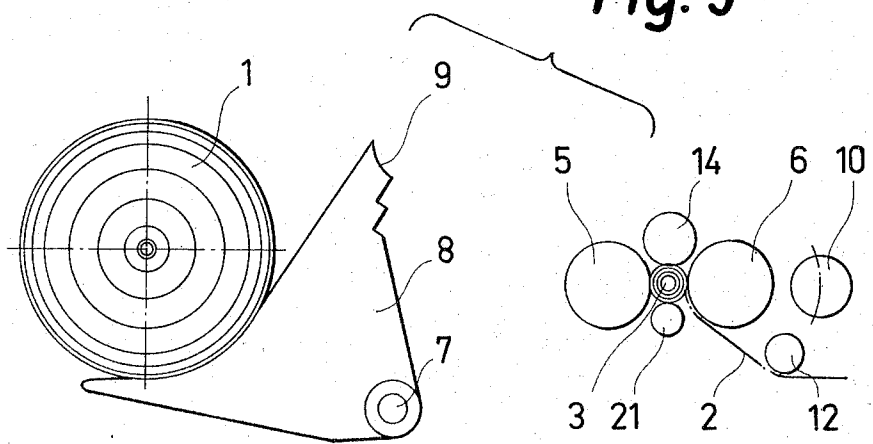


Fig. 6

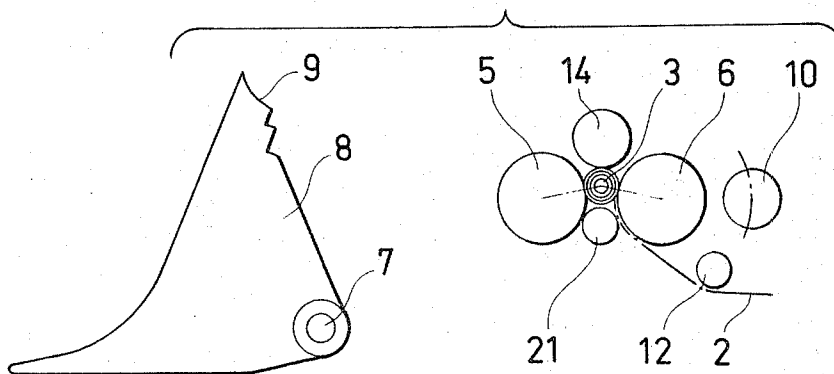


Fig. 7

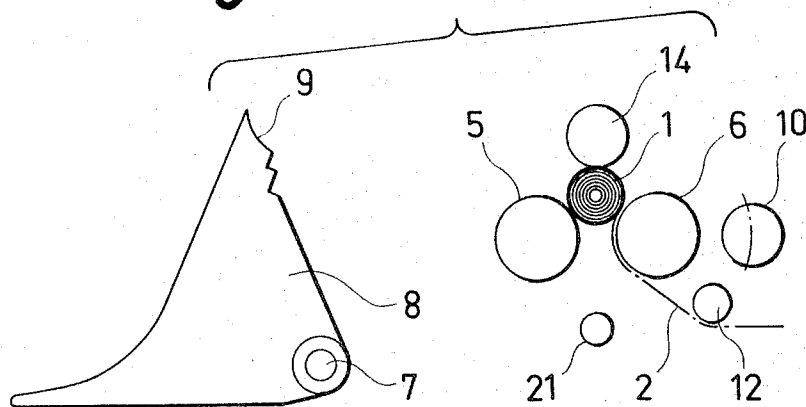


Fig. 8

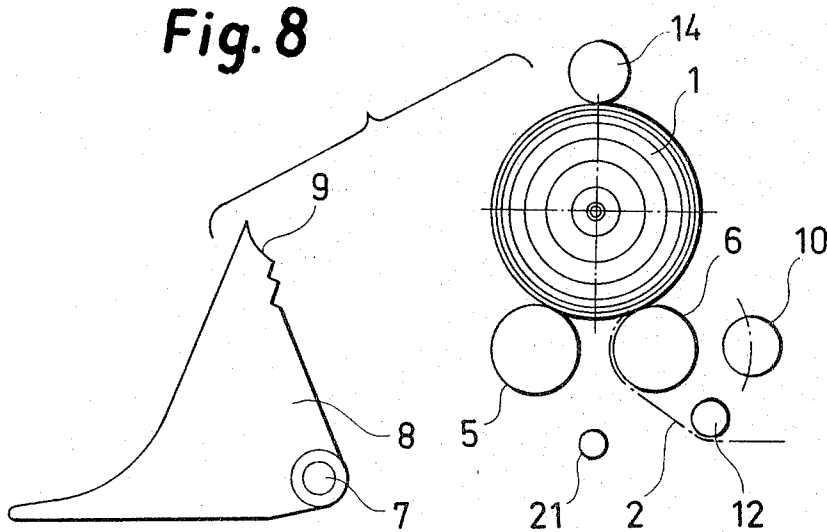


Fig. 10

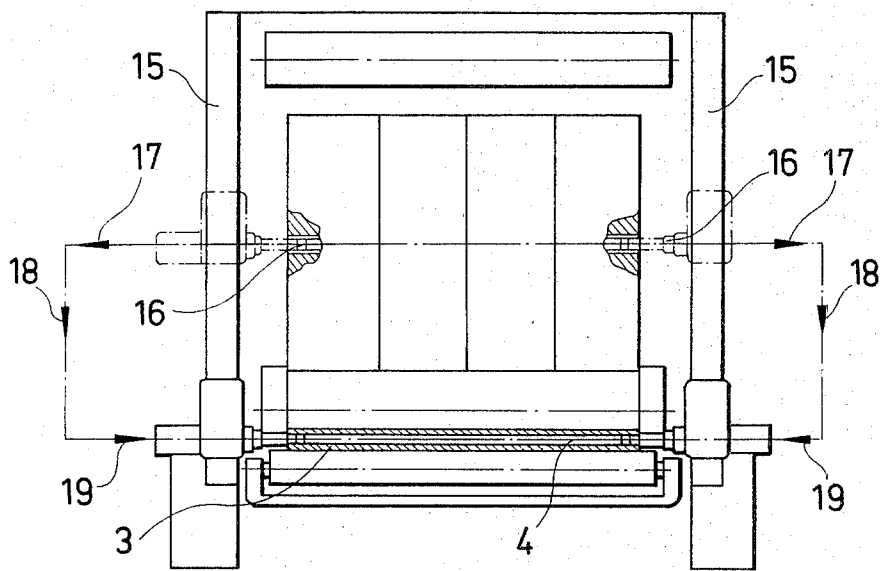


Fig. 9

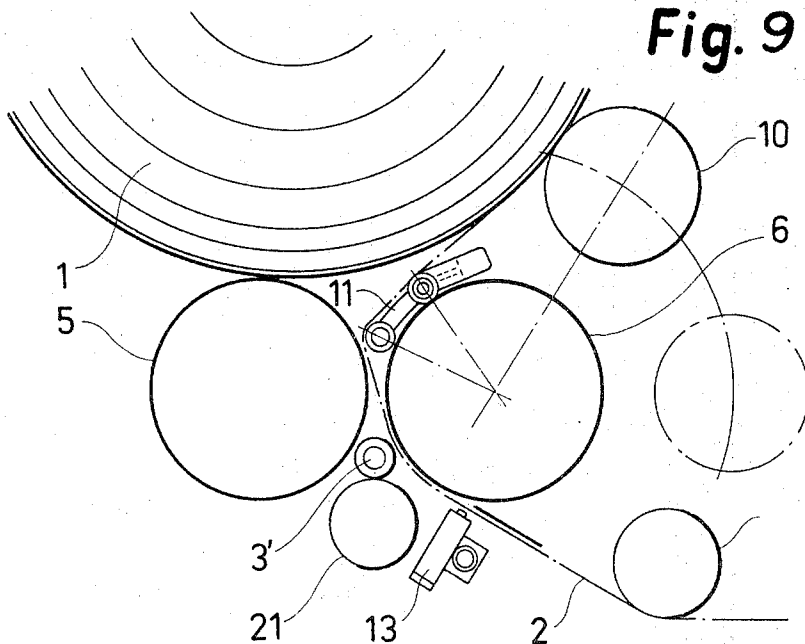


Fig. 11

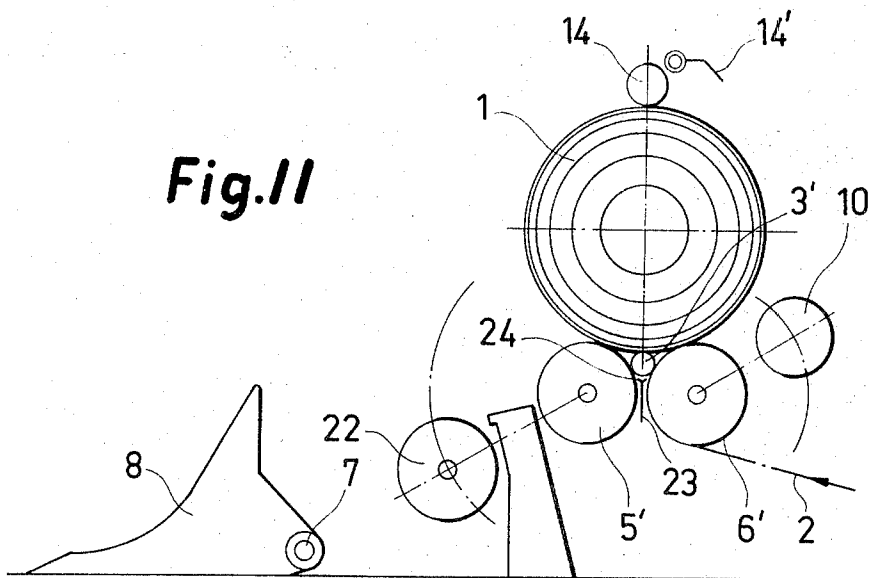


Fig. 12

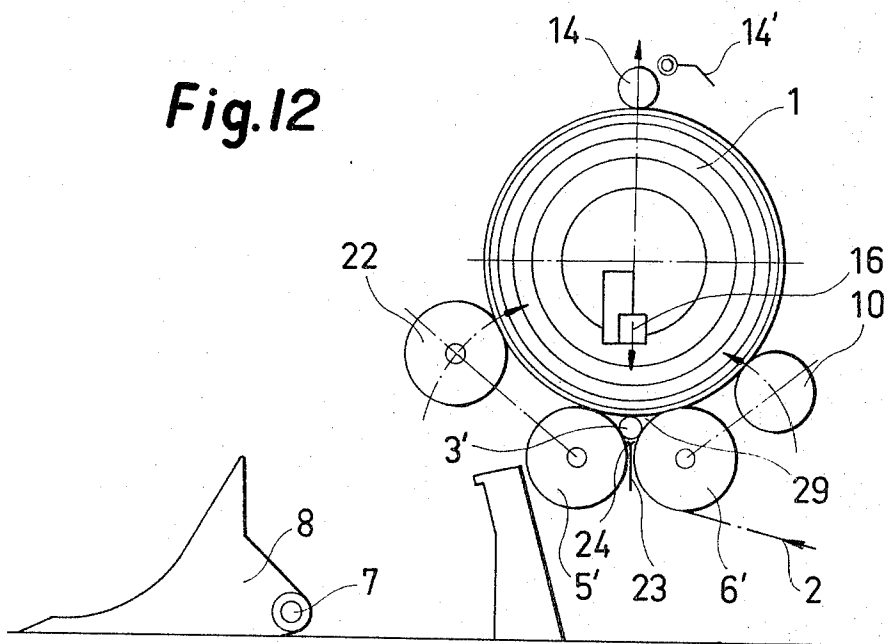


Fig. 13

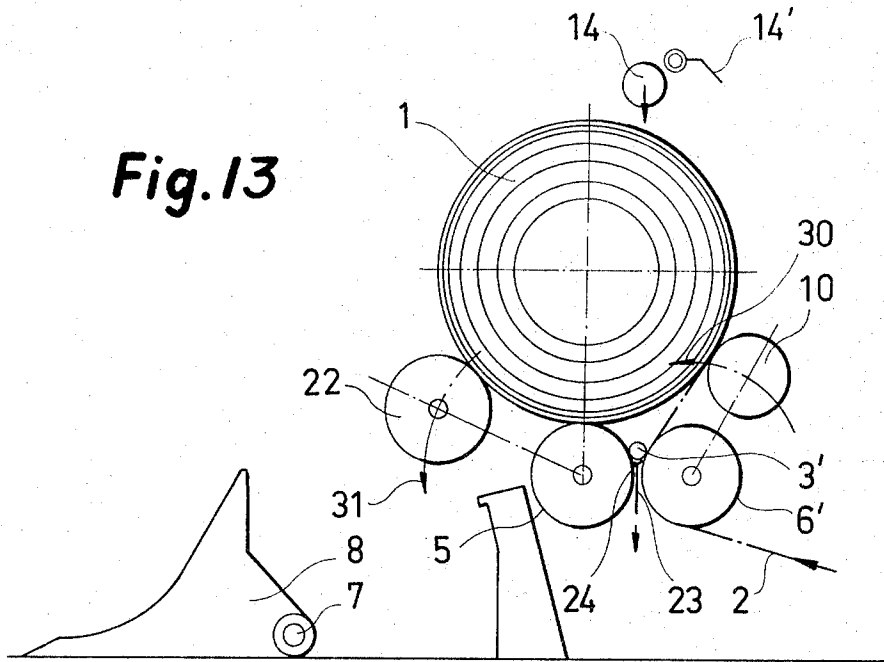


Fig. 14

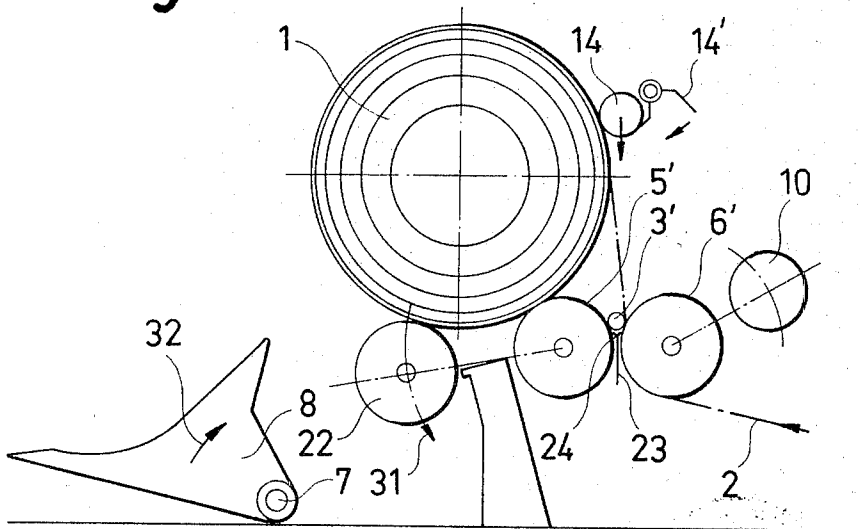


Fig. 15

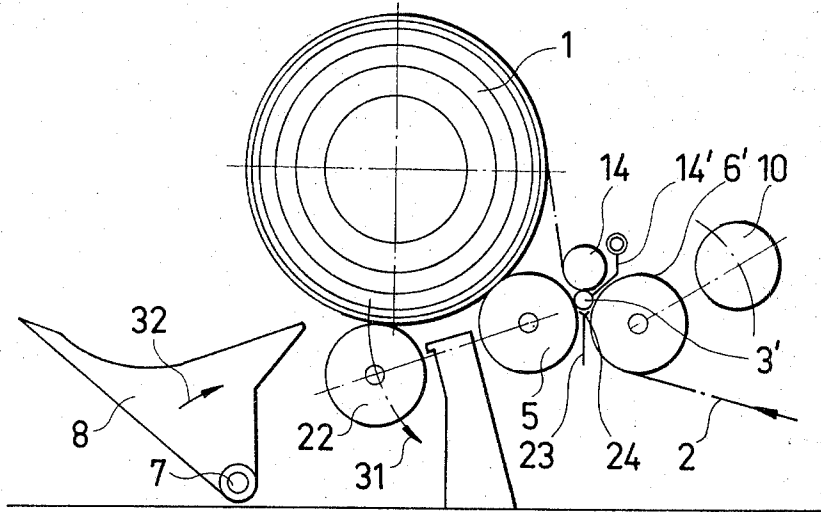


Fig. 16

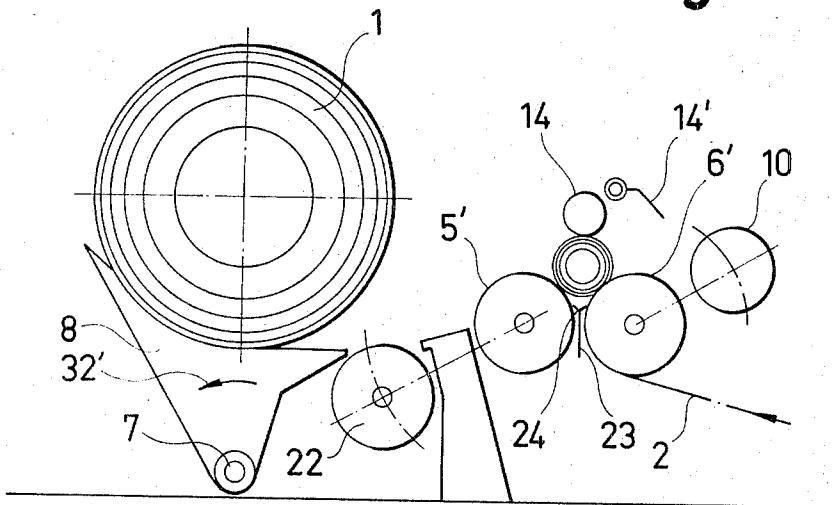


Fig. 17

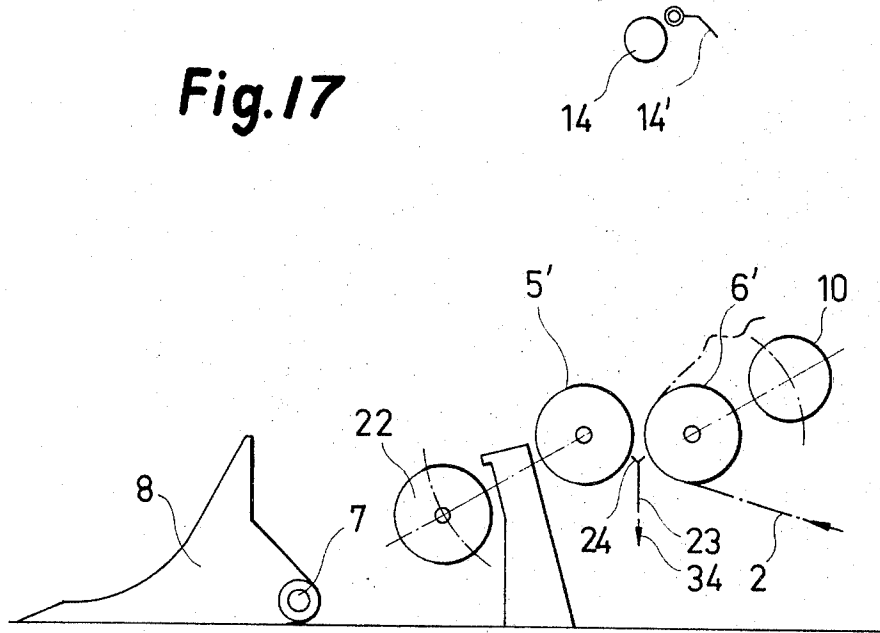


Fig. 18

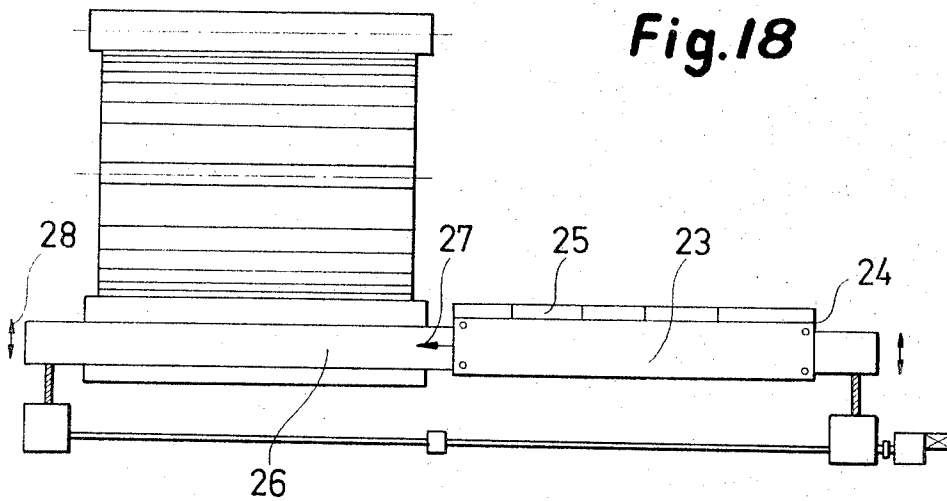


Fig. 19

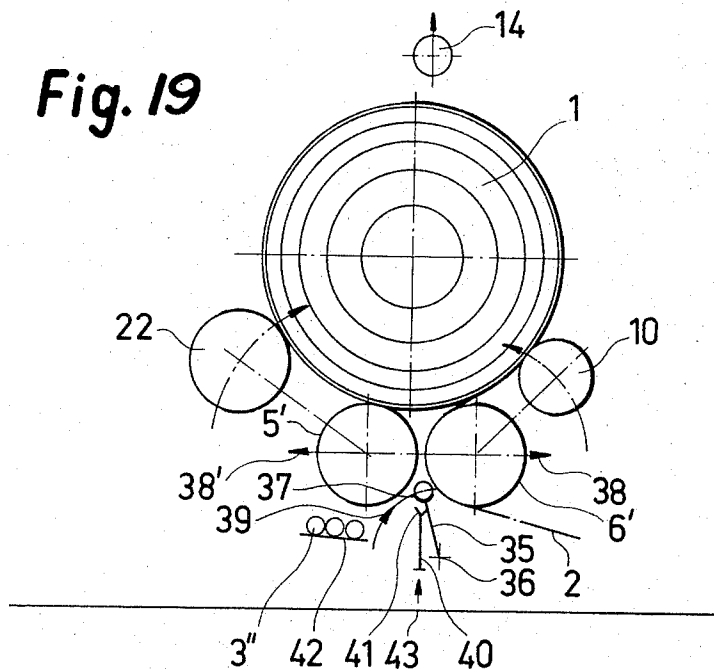


Fig. 20

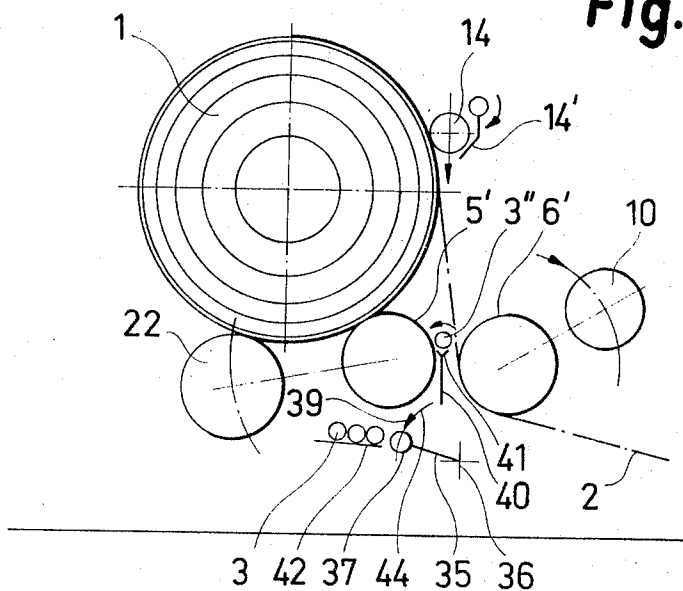
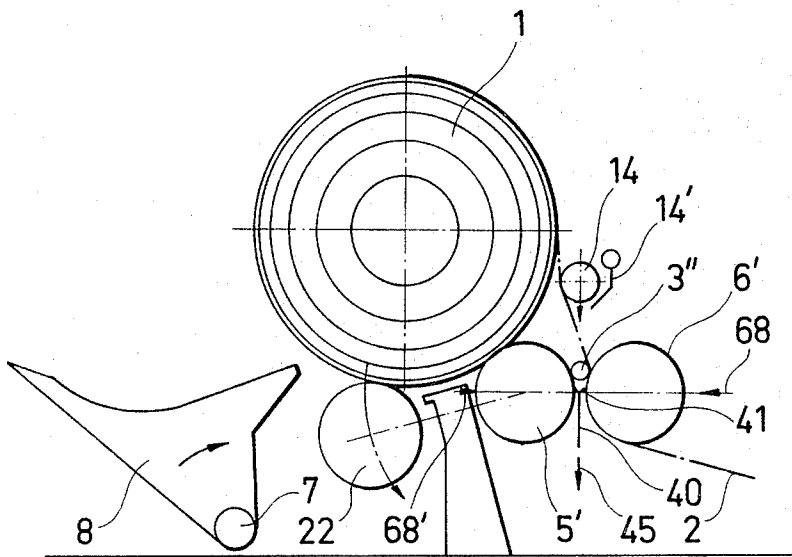


Fig. 21



METHOD AND APPARATUS FOR CONTINUOUSLY REELING WEBS OF MATERIAL INTO INDIVIDUAL ROLLS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method and apparatus for continuously reeling webs of material, particularly paper webs, into individual rolls, in which method and apparatus the roll formed on the reel is reeled while it rests against two parallel, adjacent rollers and receives its driving force from them, a new empty reel is always placed parallel in relation to the web of material, the completed roll is then cut off from the coming web of material at a point between the empty reel and the completed roll, the new free end of the web is brought into contact with the rotating empty reel, the completed roll is removed and the new reel is brought into contact with the supporting rollers, and in which the web of material is conducted between the adjacent supporting rollers for reeling.

2. Description of the Prior Art

Paper manufactured in a paper machine or a web of other material must be subjected to a series of treatment phases — or after-treatment phases — to bring it to a form appropriate for the use for which it is meant.

Formerly this was achieved by separately carrying out the first, then the second, etc. treatment phase. Each treatment was carried out in a specific separate device. The number of treatment phases determined the number of necessary devices.

Often it is also necessary to use several similar treatment apparatuses, often side by side, since uncontinuous treatment of a paper web necessitates carrying out the treatment at a higher rate than the operation rate of the paper machine. Otherwise the paper machine would produce an excessive amount of paper web.

Let us mention as an example that of the known paper types some are dampened and in that connection supercalendered in order to obtain a high degree of surface smoothness. Then the paper web is reeled, after cutting it longitudinally, into complete rolls for further processing, such as printing.

Thus, two separate apparatuses were needed for the dampening and supercalendering mentioned as an example. These two apparatuses for their part required then different working phases, namely, unreeling the roll, supercalendering, dampening, reeling into a roll, transportation, unreeling the roll, longitudinal cutting, and rolling into roll. In addition, each roll had to be fitted in place and removed.

This known after-treatment method is both inconvenient and expensive.

The treatment mentioned as an example thus requires separate apparatuses with separate driving devices, as well as the necessary reeling and unreeling devices. Each apparatus must have guide rollers, spreading rollers, web guiding organs, etc.

In addition, the quality of paper is lowered by resiliency losses caused by repeated reeling and unreeling phases.

One known apparatus for reeling continuous paper webs into individual rolls, an apparatus in which the paper web is reeled into a roll between or on two driven supporting rollers, works with an auxiliary supporting

roller which has been fitted next to one of the supporting rollers and which is supported by a frame turning around the axis of the supporting roller; the paper web is conducted over the auxiliary supporting roller. The empty reel is placed between the auxiliary supporting roller and one of the supporting rollers in a fold formed by the paper web through which it rests against the supporting roller and the auxiliary supporting roller. When a completed roll has been cut off and the reeling of paper on a new reel has started, the reel is transferred onto the supporting rollers by turning the auxiliary supporting roller. After the completed roll has been cut off it is removed by means of a lifting device. However, satisfactory operation is not obtained with this known apparatus.

The objective of the present invention is mainly to create an improved method and apparatus for reeling a continuous web of material into individual rolls.

SUMMARY OF THE INVENTION

In a reeling process of the character once described there is achieved better efficiency and performance by the improvement comprising bringing the empty reel on one side of the supporting roller always to a tangential position in relation to the web of material at a point determined by the mutual distance of the supporting rollers in such way that passage of the web and some clearance in relation to the supporting rollers is allowed, and at least almost simultaneously with the separation of the completed roll bringing the empty reel into contact with the supporting rollers and, possibly even somewhat earlier, making the completed roll to leave the supporting rollers laterally.

The advantage of this procedure is that, when the running direction of the web of material towards the reeling point remains at least essentially unchanged and without deviations from the shortest distance, the reeling can take place at the same time as the cutting of the web and placing the free end onto the new reel along an unchanged route of the web towards the reeling point.

Most suitably glue is applied at the point of the web which forms the new free end of the web of material before it arrives on the new reel. This ensures that the material will be reeled on the new reel.

Advantageously the new empty reel is placed in front of the space between the rollers on the side opposite to the completed roll and is pushed to the reeling side of the supporting rollers through the space, while the supporting rollers are moved away from each other, and later the reel is again placed on them; the space is widened for pushing the reel through by moving the rollers, and then the space is narrowed again.

This makes it possible that the reel in front of the space can be first reeled and when it has obtained a predetermined size it can be pushed between the rollers to the side of the complete roll. Lowering the reel after pushing it through does not take place in this case.

It is also possible to introduce a new empty reel in the axial direction of the supporting rollers to their reeling side between the supporting rollers and the completed roll and allowing clearance in relation to them, and to bring the reel into contact with the supporting rollers at the initial moment of its operation.

According to the invention a suitable apparatus for carrying out the process comprises adjacent parallel rollers which during the reeling process support the roll

being reeled and transmit the driving force, means for guiding the web of material between the two supporting rollers to their reeling side, a guide device guiding a new empty reel to replace the completed roll when the reel has been brought to the web entrance, means for bringing the new empty reel in front of the space between the supporting rollers so that some clearance is left in relation to them and that the reel is parallel to them, means for bringing the new reel which has been fitted in its place against the supporting rollers, a device for cutting the web of material off from the completed roll, this device working on that side of the empty reel facing the roll, and means for removing the completed roll from the supporting rollers.

According to one embodiment of the invention, the means for fitting an empty reel in front of the space between the rollers may comprise a receiving roller which is parallel to the supporting rollers and which can be lifted and lowered. It receives the empty reel coming from, for example a storage, and its lifting height allows the pushing of the reel to the reeling side of the supporting rollers. The supporting rollers can be moved in relation to each other and are subjected to pressure which tends to press them together and which is preferably regulatable so that the supporting rollers can, when they touch the reel and at the initial phase of the reeling, draw farther apart from each other until the started reel has been pushed through between them.

Another embodiment of the device for fitting a new reel in front of the space between the supporting rollers is characterized in that a flat support which can be pushed in the axial direction of the supporting rollers from their one end into the space between the rollers and which has been provided with a supporting groove on its upper side, the groove being on the reeling side when the flat support is pushed in, has been fitted to the apparatus so that it can be lifted and lowered. In this embodiment, an empty reel, when it is pushed in, ends up between the completed roll and the supporting rollers. When the flat support is later lowered, the reel descends onto the supporting rollers. The support is then pulled out again.

Another embodiment of the apparatus for placing an empty reel in its place is characterized in that, for moving an empty reel coming for example from a storage, two pairs of arms have been provided above the supporting rollers, the outer ends of the arms having been fitted with supporting end plates and the outer ends of one pair of the arms being capable of turning from the reception place of the empty reel to beneath the space between the rollers, and the arms of the other pair being capable of being lifted and lowered vertically through the space between the rollers; when they are lifted they pick the empty reel from the arms of the first pair to bring it through the space between the rollers and when they are lowered they place the empty reel to rest against the supporting rollers, in which case at least one of the supporting rollers can be moved closer to the other roller and away from it.

A load roller which rises when the roll increases, which can be lifted and lowered, and which has a regulatable load and web cutting devices connected with it has been provided for the roll to be reeled. The load roller is necessary for flawless reeling.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1-8 illustrate the first embodiment of the reeling apparatus and its operation.

FIG. 9 is a partial enlargement of FIG. 3.

FIG. 10 shows in detail the placement of the centering pins.

FIGS. 11-17 illustrate another embodiment of the reeling apparatus and its operation.

FIG. 18 shows a device for fitting a new empty reel in its place in the embodiment according to FIGS. 12-18.

FIGS. 19-21 show a modification of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1-21, the roll which is being reeled or which has been reeled is indicated by 1. In these examples, the web of material is a paper web and is indicated by 2. For its reeling, one or several adjacent reels 3 have been arranged on shaft bar 4 (FIG. 10). Several reels are used when a longitudinally cutting device has been provided in front of the reeling apparatus to divide the coming paper web into individual narrow webs.

The apparatus includes two parallel supporting rollers 5 and 6 on which the reel is reeled. At least one of the supporting rollers is driven. On the left, next to supporting roller 5, there is reception and delivery platform 8 which turns around shaft 7, and side 9 of the platform facing supporting roller 5 is concave, corresponding to supporting roller 5. On the opposite side, the right side, is pushing roller 10 which can be turned against completed roll 1. Also fitted on this side is cutting and fitting device 11 along with blowers; this device can be moved into the operating position. Spreading roller 12 works to guide paper web 2 to the reeling point. The spreading roller has a degree of freedom upwards, that is, it can swing to reduce increases in tension when the fitting roller presses the paper web. Number 13 indicates the glueing device for the free web end formed when the completed roll is cut off from the web. Number 14 is a load roller for the roll created in the reeling process. The compressive pressure of the load roller is usually regulatable. The centering device for the roll being formed is shown in FIG. 10. It consists of two side poles with guide rails 15 along which centering pins 16 can be lifted and lowered in the vertical direction, as well as pushed in and pulled out. When the roll has been reeled, the centering pins are pulled back in the direction indicated by arrows 17 so that they are detached from the grip and release the completed roll. Then the centering pins are moved downwards in the direction of arrows 18, and by moving them in the direction of arrows 19 they are brought to grip the new empty reel which is on roller 21 which can be lifted and lowered. When pushed forward, the centering pins grip the ends of the empty reel which extend over shaft bar 4. New empty reels 3' come from storage 20. One empty reel at a time is brought from the storage onto roller 21 which can be lifted and lowered. The reel is placed on roller 21 by a turning arm which is respectively turned front and back.

The operation of an apparatus according to FIGS. 1-10 is as follows.

FIG. 1 shows roll 1 in the completed state. Load roller 14 continues to rest against roll 1. Pushing roller 10 is also in its initial position. Empty reel 3' has been

moved onto roller 21 which can be lifted and lowered. Roller 21 is in the lowered position. Then load roller 14 is lifted to the position shown in FIG. 2 and pushing roller 10 is turned against the completed roll. Roller 21 is lifted so that empty reel 3' rises to the lower part of the space between the rollers. Centering pins 16 are pulled out from the completed roll and brought to grip the empty reel (FIG. 10). As the operation continues, pushing roller 10 turns further lifting completed roll 1, as shown in FIGS. 3 and 9. While pushing roller 10 is turning further and possibly even earlier, cutting and fitting device 11 turns to the position shown in FIGS. 3 and 9. By means of device 13 the end of the reeled web can be glued onto the completed roll. The completed roll is cut off from the web 2 and the new free web end is guided from the left onto the new empty reel with the help of the fitting device. Fitting the web around the reel is facilitated by a blower, not shown in the figure, which can be situated in connection with the cutting and fitting device. The new free end of the web settles on reel 3', which begins to rotate, since having been lifted it has come into contact with the supporting rollers and is rotated by them. In addition, while the pushing roller is turning further and the cutting and fitting device is turning, glueing device 13 spreads glue at the new free end of the paper web on the side which is turned against the empty reel so that the web is glued onto the reel and is caught by it for reeling. Since roll 1 is rotated until it reaches the position shown in FIG. 4, no free web end will be left hanging from the roll. Roller 21 which pushes the roll away and cutting and fitting device 11 have turned back to their initial positions. The completed roll can be removed with the help of platform 8. The web is reeled on the new reel, and supporting rollers 5 and 6 are pressed away from each other as the reeling progresses, the rollers being attached with bearings to gliding guides and being under hydraulic pressure which pushes them away from each other, the force being measured and controlled. Load roller 14 descends and passes the completed roll which at the same time is ready to be delivered. When the roll on the new reel has obtained a predetermined size, roller 21 is again lifted to push the started new roll through between the supporting rollers (FIG. 5) so that the reel ends up on the other side of the supporting rollers. Load roller 14 ends up against the new reel. FIG. 6 shows the growth of the roll to the size at which it is pushed through. FIG. 7 shows the new reel after it has been pushed through. Roller 21 has again been lowered to its initial position. FIG. 8 shows the roller geometry which can be controlled almost until roll 1 is completed by moving supporting rollers 5 and 6 away from each other. Roll 1 is therefore reeled calmly. Load roller 14 is pressed with controllable pressure. A little before changing the reel, the supporting rollers are brought to the initial position according to FIG. 1. A new operation cycle can begin. During the entire reeling, the paper web is never left on its own.

The embodiment according to FIGS. 11-17 differs from that shown in FIGS. 1-10 mainly in that the feeding of an empty reel from below has been changed and that the transfer of the completed roll onto delivery platform 8 takes place in a different manner.

In the embodiment according to FIGS. 11-17, supporting rollers 5' and 6' are stationary. Furthermore, additional supporting roller 22 has been fitted on the side facing delivery platform 8 and this roller turns

around the axis of supporting roller 5'. Reception and delivery platform 8 is in the receiving position at some distance from supporting roller 5'. This distance is bridged by additional supporting roller 22. This supporting roller 22 works as a transferring roller when the completed roll is placed on the delivery platform.

The device working to move a new empty reel in front of the space between supporting rollers 5' and 6' (FIG. 18) consists of flat support 23 which can be moved in the axial direction of the supporting rollers, which can be pushed into the space between the rollers from their one end, and which can be lifted and lowered. At the upper part of the support there is channel or groove 24 for receiving a new empty reel or several reels 25 pushed on a bar, as shown in FIG. 18. The flat support can be moved in the axial direction of the supporting rollers on tilted rail 26 fitted between the rollers. The support is also lifted and lowered with the help of this tilted rail. Arrow 27 in FIG. 18 indicates the movement of the flat support in the axial direction of the supporting rollers. Double arrow 28 indicates lifting and lowering. Cutting device 14' is connected with load roller 14 (FIGS. 11-17).

FIG. 11 shows the apparatus with completed roll 1 before proceeding to new empty reel 3'. Pushing roller 10 has been turned away from roll 1. Delivery table 8 is in the turning position in which it delivers the completed roll. Load roller 14 is against roll 1. New empty reel 3' has moved from one end of supporting rollers 5' and 6' to triangle 29 (FIG. 12) between supporting rollers 5' and 6' and roll 1. When entering, empty reel 3' does not touch supporting rollers 5' and 6'. Neither does it touch roll 1 or touch it immediately thereafter. The lowering of the reel to touch supporting rollers 5' and 6' does not take place until later.

In FIG. 12, the transfer of the paper web onto empty reel 3' is beginning. Pushing roller 10 has been turned against roll 1. Additional supporting roller 22 has also been turned towards roll 1. Centering pins 16 have been pulled out and they are moving downwards towards empty reel 3'. Load roller 14 is lifted. The situation according to FIG. 13 is created in which pushing roller 10 has pushed roll 1 onto the supporting set-up formed by supporting rollers 5' and 22. Additional supporting roller 22 is turning downwards. The turning directions of pushing roller 10 and additional supporting roller 22 are indicated by arrows 30 and 31.

After roll 1 has been forced onto supporting rollers 5' and 22 (of FIG. 14), pushing roller 10 again turns to the initial position. Additional supporting roller 22 turns further downwards. Delivery platform 8 begins to turn in the direction of arrow 32. The empty reel is lowered so that it ends up on supporting rollers 5' and 6' and begins to rotate at the rate of the paper web under the influence of these two driven rollers. Paper web 2 is between the right-side supporting roller 6' and reel 3'. This acceleration of a new empty reel is preferably used only with stronger type of paper. Thin paper could be torn. Load roller 14 runs down along the circumference of roll 1 until it reaches the position shown in FIG. 15 at which cutting device 14' begins operation.

Additional supporting roller 22 is still turning downwards and the delivery platform continuing its turning movement. A new free end is formed for the paper web and it begins to be reeled on a new reel. At this stage the side of the free end facing the reel can be covered with a layer of glue as in the embodiment first de-

scribed. The free end of the web can also be blown against the reel with a blower.

In the position according to FIG. 16, additional supporting roller 22 is completely lowered and delivery platform 8 completely turned so that completed roll 1 can roll onto delivery platform 8. The latter is turned in the direction of arrow 32' for the delivery of the roll. The web is again reeled into a new roll on the new reel, the load roller rising when the roll grows.

FIG. 17 shows how the web can be introduced into the apparatus after it has been cut. Flat support 23 is pulled out parallel to the supporting rollers and then lowered with the help of tilted rail 26 so that the rail can be drawn in without hindrance. The lowering is indicated by arrow 34.

Through the introduction of a new empty reel the situation according to FIG. 11 is again created and a new operation cycle begins from this situation.

The control of the centering pins is the same as in the previous embodiment.

FIGS. 19-21 illustrate another method for bringing a new empty reel between the supporting rollers in the apparatus shown in FIGS. 11-17, in which case supporting rollers 5' and 6' can be moved closer to and further apart from each other with supporting roller 6' moving in relation to supporting roller 5' or, most advantageously, with both rollers moving symmetrically in relation to each other. The moving directions are indicated in FIG. 19 by arrows 38 and 38' and in FIG. 21 by arrows 68 and 68'. Reels 3'' come from a storage space between rollers 5' and 6'. That end of arm 35 which is directed away from the space between the rollers turns around shaft 36, and its other end which is turned towards the space is provided with end plate 37 for receiving the reel. In addition, arm 40 has been provided; its end which is towards supporting rollers 5' and 6' is fitted with receiving end plate 41 and it can be lifted and lowered perpendicularly against the connecting line of the roller axes and can extend through the space between the rollers. Several arms 35 and 40 have been fitted so that they can pass each other when they move.

The reeling space for roll 1 shown in FIG. 19 corresponds to that shown in FIG. 14. In FIG. 19, the end plate of arm 35 has received a reel from receiving plate 42, and by turning in the direction of arrow 39 the arm has brought the reel in front of the space between the rollers, as shown. By rising in the direction of arrow 43, end plate 41 of arm 40 takes the reel from the end plate of arm 35 and lifts the reel to the other side of the supporting rollers, as shown in FIG. 20. Supporting roller 6' along with pushing roller 10 has then been moved to the right to increase the space between the rollers, or both supporting rollers 5' and 6' have been moved symmetrically. Arm 35 has again been turned in the direc-

tion of arrow 44 in front of the space to receive the reel.

The reeling situation shown in FIG. 20 corresponds to that shown in FIG. 14. When the reel has risen through the space between the rollers, supporting rollers 5' and 6' are again moved closer to each other and arm 40 is lowered so that the reel ends up against supporting rollers 5' and 6' (cf. FIG. 21). The lowering direction is shown by arrow 45. The end plate of arm 40 is only so broad that it can move through the remaining space between the rollers. The reeling situation shown in FIG. 21 corresponds to that shown in FIG. 15. Arm 40 is lowered while operation is continued according to FIGS. 16 and 17 fully to the position shown in FIG. 19, and arm 35 is turned to the position shown in FIG. 19.

I claim:

1. Apparatus for reeling webs of material into rolls which comprises a pair of rollers disposed in opposite parallel spaced relation, at least one of said rollers being rotatably driven, a first reel positioning means, and a second reel positioning means, said first reel positioning means including means for supporting a first reel upon which the web has been wound into a roll and to position such roll for contact reaction with said rollers at a first set of contact zones thereon, said second reel positioning means including means for positioning a second reel for contact with the web and for contact reaction with said rollers at a second set of contact zones thereon, and means to start winding of the web upon said second reel upon termination of winding of the web upon said first reel.

2. Apparatus according to claim 1 wherein said first set of contact zones and said second set of contact zones are on respective opposite sides of the plane defined by the rotation axes of said rollers.

3. Apparatus according to claim 1 wherein said first set of contact zones and said second set of contact zones are on the same side of the plane defined by the rotation axes of said rollers.

4. Apparatus according to claim 1 wherein said first reel positioning means includes a moveable reel support operable to engage the second reel when same is brought to a pick-up position by said second reel positioning means.

5. Apparatus according to claim 1 wherein said second reel positioning means includes means for moving the second reel axially into the space above a plane containing the centers of said rollers and below the web roll on the first reel.

6. Apparatus according to claim 1 including transfer means cooperating with said first reel positioning means and operable to discharge the first reel and web roll thereon from the rollers and first reel positioning means in a direction transverse to the axis of winding.

* * * * *